Characterization Of Mineralization in Sediments Around Potential Methane Hydrate Fractures

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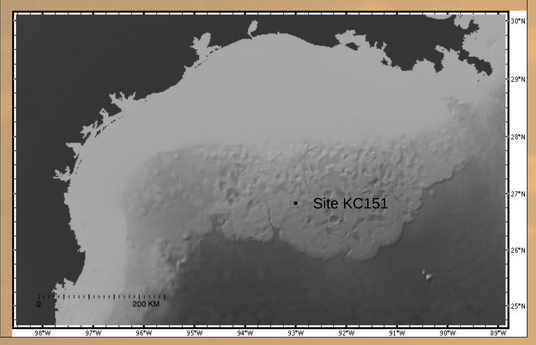
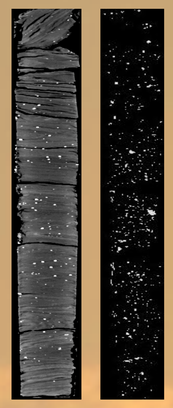
Introduction

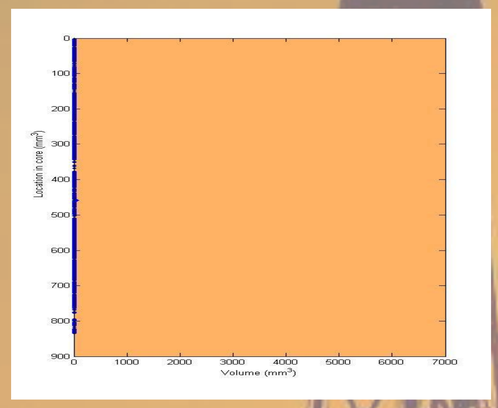
Methane hydrates are a combination of natural gas and H_2O. Though current technology makes extracting methane hydrates impractical, this may be a future energy source. This poster is looking at hole KC 151 from the Gulf of Mexico which has been known to contain Methane Hydrates. Although the Hydrate cannot maintain stability at standard temperature and pressure, I'm looking for physical and chemical changes in the sediment left by the hydrate. This poster is focusing on the mineralization patterns in the sediment core.

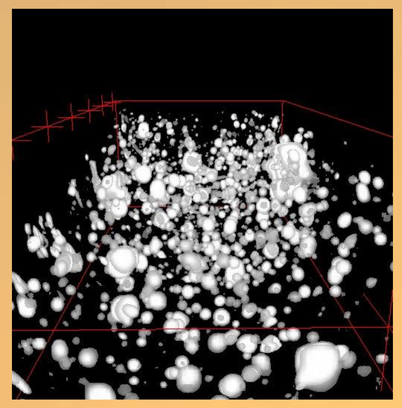


Methods

By using an X-Ray Computed Tomography scanner (XCT) the core's density variations are more clearly depicted. Increasing the number of rotations and using lower settings the XCT produces a highly detailed image of the core's structure. I used FIJI to visualize the high density minerals that are more dense than the surrounding sediment. Using FIJI I obtained the pixel volume of the high density objects and the total volume of the core. Due to expense of obtaining the original core, I was only able to obtain the images for 17H-4 in my lab. Other XCT scans performed at NETL in Morganstown, West Virginia.

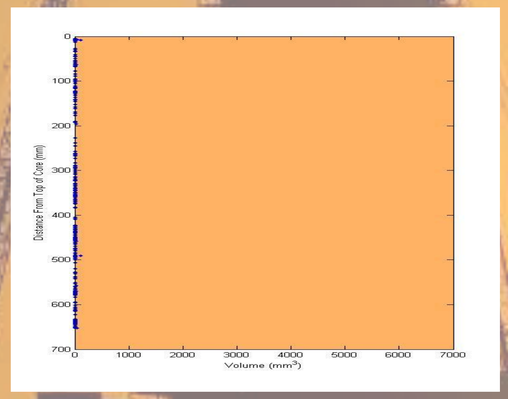


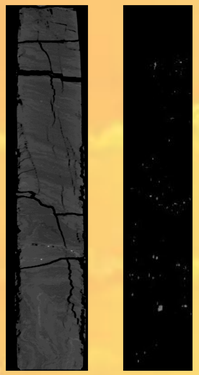




JIP-1 KC151 8C-1

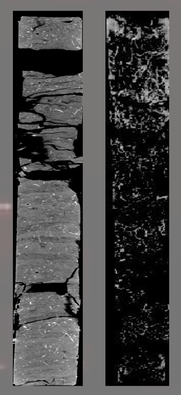
Top of the core is at 214.8 mbsf. Mineralization in this segment is nodular grains of pyrite. The percentage of High density material in this core is very low, calculated to be .77% of overall volume. A close-up of the nodules is pictured to the right. It is interesting to note the highly dipping fractures at the top of the core.

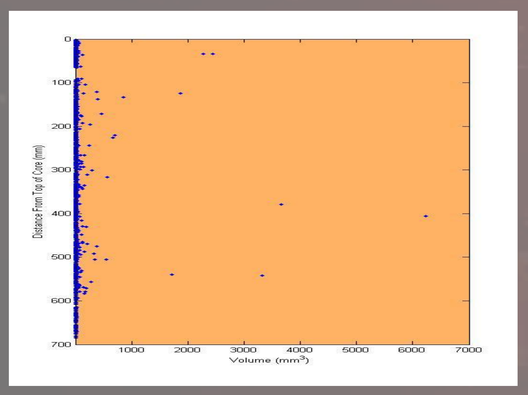


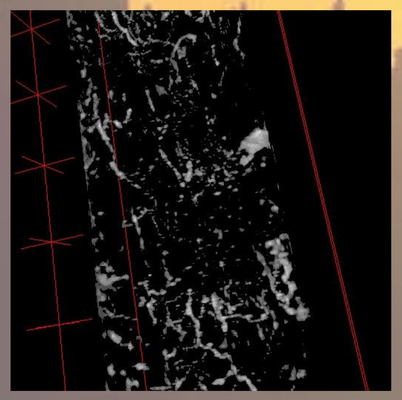


JIP-1 KC151 12C-1

Top of core is at 230.1 mbsf. The core has a few interesting features that are imaged well with XCT, such as the the dipping sediment layers in the top half of the core, followed by a disturbance feature that has voids and pyrite inside it. (circled in red). Core has little mineralization, amounting to .078% of total volume. Mineralization is concentrated in areas with high fracturing.



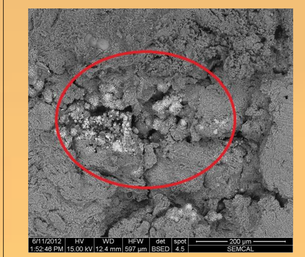


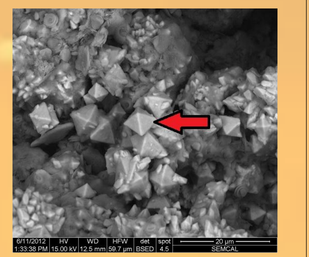


JIP-1 KC151 17H-4

Top of core is at 259.1 mbsf and has high level mineralization of bioturbation. There is a high angle fracture in the top third of the core, thought to be left by a methane hydrate this corresponds with somewhat higher mineralization as depicted on the graph above. This segment of core has a high level of mineralization, calculated to be 5.5% of total volume.

Results





- SEM imaging suggests pyrite morphology in the bioturbation. Pictured above left is a surface exposure of this bioturbation, above right is close up of pyrite crystal.
- All core segments shown are from the gas hydrate stability zone of hole KC151. The mineralization regime in the upper part of the core (215 mbsf) starts as precipitated pyrite nodules. This changes for core section 17H1-4 and is mineralized bioturbation rather than precipitated nodules. Just 17H-4 is shown.

- 17H-4 shows a large fracture that could have been a methane hydrate, and also contains 5.5% high density material, likely pyrite as shown in SEM images. (fracture pictured on right)
- In the future, I would like to continue researching this subject through a TOC analysis and examining the fracture surface itself with a micro XCT scanner to fully characterize the physical artifacts left by the evaporating methane hydrate.

Acknowledgements

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